ICTD
المركز العالمي للتدريب والتطوير
International Centre For Training & Development

ICE002

Advanced Process Control for Engineers and Technicians

Course Introduction:

Advanced Process Control and Loop Tuning and Analysis is designed to provide engineers and technicians with the basic theoretical and practical understanding of the process loop and how this can be applied to optimize process control in terms of quality, safety, flexibility and costs.

Course Objectives:

Upon successful completion of this course, the delegates will be able to:

- ✓ Fundamentals of process control
- ✓ The effect of P.I.D tuning
- ✓ Recognize different control algorithm
- ✓ Understand cascade and feed forward control
- ✓ Lead lag and ratio control
- ✓ How to decouple the interacting loop
- ✓ Appreciate the effects of different valve characteristics on the loop performance
- ✓ Analyze such problems as valve hysteresis, stiction and non linearities
- ✓ Fully appreciate the effects of proportional, integral and derivative control
- ✓ Correctly apply both open and closed Loop Tuning according to Ziegler Nichols
- ✓ Understand cascade and feed forward control
- ✓ Appreciate the rationale for using Ratio control and Adaptive control systems

Who Should Attend?

This course is intended for all engineers & technicians in the field of Instrument and control, Automation, Chemical, Consulting, Design & Project, Electrical, Maintenance and Operations.

Course Outline:

Day 1:

Pre Test

Introduction

- Control objective
- Closed control loop
- Control strategies
- Feedback control
- Feed forward control

Basic components control system

- Sensor and transmitters

- Controller, action of controllers
- Final control element
- Control valve gain
- Windup reset control

Day 2:

Process control fundamental

- ON/OFF control
- Proportional control
- Proportional band vs. proportional gain
- Proportional offset
- Reset
- Integral action
- Integral windup
- Stability
- Derivative action
- PID control
- Load disturbances and offset

Advanced control Algorithm

- Feed forward control
- Cascade Control loop
- Self-tuning
- Ratio control
- Split range control

Day 3:

Loop tuning

- Basic principles
- Open loop reaction curve method (Ziegler – Nichols)
- Default and typical settings
- Closed loop continuous cycling method (Ziegler – Nichols)
- Override and selective control
- Ratio and feed forward control

Control Algorithm

- Stability consideration
- Two level cascade
- Three level cascade
- Fine tuning
- Tuning for load rejection vs. set-point rejection

- Tuning for different vs. robustness
- Surge control

Elements of advanced control loop

- Smart transmitter it, advantage
- Final control elements with smart positioned
- Microprocessor or based controller
- Organization of control element to have a feedback control system
- Disadvantage of feedback control system
- How to overcome the disadvantage of fee back control system

Day 4:

Advanced control algorithms

- Why we choose the advanced control system
- Stage of development of advanced control system
- Difference between feedback & feed forward control system
- Cascade control system
- Feedforward control system
- Ratio control system
- How to combine the advantage of feedback and feedforward
- Adaptive and self-tuning control loops

Multi variable controls

- Interacting loops (severity of interaction)
- Relative gain array calculation
- Decoupling interactive multivariable control loops
- Statistical analysis

Day 5:

Final control element

- Pressure recovery
- Flashing and cavitation's
- Valve construction
- Valve characteristics
- Inherent
- Installed
- Cavitation's control
- Actuators
- Diaphragm
- Cylinder
- Electric

- Valve positioners
- Deabband and hysteresis
- Stick-slip
- Testing procedures and analysis
- Effect of valve performance on controllability

Digital control system

- Communication fundamental
- Migration to experion
- Introduction to fielbus, profibus
- Application of control system
- Case studies
- Boiler control
- Level drum control
- Single element
- Two element
- Three element

Ratio control

- Series limited control
- Parallel limited control
- Lead lag firing

Fractionator control

- The reflux rate
- The reboiler heat input
- The fractionators pressure
- The feed rate
- The feed temperature

Post Test

Course Certificate:

International Center for Training & Development (**ICTD**) will award an internationally recognized certificate(s) for each delegate on completion of training.

Course Methodology:

A variety of methodologies will be used during the course that includes:

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionaires
- Group Work
- Discussion
- Presentation

Course Fees:

To be advised as per course location. This rate includes participant's manual, and-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Timings:

Daily Course Timings:

08:00 - 08:20	Morning Coffee / Tea
08:20 - 10:00	First Session
10:00 - 10:20	Coffee / Tea / Snacks
10:20 - 12:20	Second Session
12:20 - 13:30	Lunch Break & Prayer Break
13:30 - 15:00	Last Session